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PLEASE NOTE

This report presents unevaluated information on Soviet-Bloc activities in the International Geophysical Cooperation program from foreign-language publications as indicated in parentheses. It is published as an aid to United States Government research.

"INTERNATIONAL GEOPHYSICAL COOPERATION" PROGRAM-- SOVIET-BLOC ACTIVITIES

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I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Soviet Writer Foresees Habitable Moon With Artificial Atmosphere

A habitable Moon is envisioned by F. Zigel', Candidate of Pedagogical Sciences, as a possibility of the future.

The lunar world, devoid of atmosphere and water, is a lifeless desert, unsuitable for human habitation. But this, says Zigel', is only a condition which exists at present. In the future, the Moon will be transformed into a unique branch of the Earth and conditions for life there will become fully acceptable for man.

The first man to walk on the moon will wear some sort of space suit. Then he will build the first lunar habitation, hermetically insulated from the airless ranges of space, and will possibly be situated in depressions in the lunar rock. After this will come the first lunar cities.

Air and moisture for lunar habitations will not be carried from Earth but will be obtained from the lunar rocks themselves by physical-chemical methods.

It is possible that the Moon is extremely rich in natural resources, in particular uranium ores. Powerful atomic power plants will make it possible, in time, to create an artificial atmosphere around the Moon. Nitrogen, oxygen, and other gases will be continuously created by "atmosphere-generators," installations synthesizing these gases from the chemical elements of the lunar crust. The loss of lunar atmosphere into surrounding space can be continuously replenished by this artificial means, by using a sufficiently large number of these "generators."

Man will surround the Moon with a warm blanket of atmosphere. He will create artificial clouds and cause the first rains to fall on its barren surface, and life will flourish.

Zigel' predicts this will come to pass in a century or even less. And afterwards, by this same means, will come the conquest and settlement of the more distant celestial bodies, Mars, Venus, and possibly Mercury.

The pattern for this will be initial scouting flights, followed by landings on the surface of the celestial body, and finally, conquest and settlement.

The most promising means for travel in interstellar space is the use of photon rockets; propulsion by light.

Modern concepts of the photon rocket are suggestive of a gigantic projector. However, the source of light in a photon rocket is altogether different from that of a searchlight.

As is known, there exist in nature, in addition to the usual "elementary" particles of matter (the protons, neutrons, and electrons), their opposite according to electrical charge and magnetic properties, "antiparticles" (antiprotons, antineutrons and positrons). When the usual particles collide with their own antiparticles, they are both immediately, or through a series of intermediate states, converted into photons. The energy of this process, which is called annihilation, is emitted in the greatest possible quantity. If, says Zigel', 100 tons of matter were annihilated, the energy thus liberated would be so great that it would equal all that produced by man for the last 2,000 years.

It is proposed to use the annihilation process for obtaining superpowerful streams of light in photon rockets. The combination of jets of the usual particles with artificially obtained antiparticles will produce a powerful radiation which, through the use of the photon rocket's reflector, will give the desired motion.

The idea of a photon rocket is still far from realization. It is clear how antiparticles may be obtained. The difficulty lies in where and in what containers it will be possible to store the "antimatter," since contact with the wall of the container will immediately lead to annihilation. The flows of radiation will be so powerful that the reflector will be evaporated if it is not made of some superresistant materials or if the "hard" and very powerful primary radiation is not converted into less powerful, but safe, radio waves.

While the technical realization of the photon rocket is still far off, it is clear that one of these motors will open man's path to the stars.

Zigel' says that the conquest of the lunar world will come about in the time of the present generation. ("The Cosmic Future of Mankind," by F. Zigel'; Moscow, Znaniye-Sila, No 1, Jan 59, pp 12-14)

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Atomic Energy in Aviation and Rocket Engineering, a New Book

A new book in the "Popular-Science Library" series which will be issued by Voyenizdat in March or April is Atomnaya Energiya v Aviatsii i Raketnoy Tekhnike (Atomic Energy in Aviation and Rocket Engineering). This is a collection of articles describing the development of atomic and thermonuclear weapons and their carriers, the problems of reactor shielding in airplanes, and the application of atomic energy in aviation and rocket techniques. ("These Books From Voyenizdata Will Be Issued in March-April"; Moscow, Sovetskaya Aviatsiya, 25 Mar 59, p 4)

Soviet Rocket Exhibit in Berlin

The exhibit, "Soviet Rockets in the Cosmos," which opened in Berlin during the last part of February, is reported to be a great success. It has attracted more than 20,000 visitors from East and West Berlin, from the German Democratic Republic and from West Germany to date. ("Brief Reports"; Moscow, Pravda, 26 Mar 59, p 4)

II. UPPER ATMOSPHERE

Study on the Nature of Supernova Outbursts

A precise calculation of the mass of a supernova shell, taking into consideration the change in its density, is made in an article in source. It is shown that a change in density has no effect on the size of the shell mass. Taking into account the scattering of light in the free electrons of the isothermic shell with a temperature, $T = 10^4$ degrees, and a magnitude, $M = 19^{max}$, the mass exceeds the solar mass by ten times ($10m_{\odot}$), which forced the authors to select a higher average temperature. Taking into consideration the scattering of light by free electrons, the necessary mass at a temperature of $T = 10^6$ consists of $8m_{\odot}$, which considerably exceeds the mass of the Crab Nebula. The bolometric luminosity with standard chemical composition is equal to -29^m, which leads to insurmountable difficulties in energy calculations for the thermal mechanism of the growth of the outburst. Thus, the earlier conclusion made by one of the authors on the nonthermal nature of supernovae radiation is again confirmed. ("On the Problem of the Nature of Supernovae Outbursts," by I. M. Gordon and V. N. Lebedinets, Kharkov Zootechnical Institute, Kharkhov State Pedagogical Institute, imeni G. S. Skovorodi; Kiev, Dopovidi Akademii Nauk Ukrainskoi RSR, No 12, 1958, pp 1,320-1,323)

Cosmic Radiation and Perturbations in the Electrotelluric Field

Certain data concerning the distribution of electrotelluric perturbations in connection with latitudinal changes in the intensity of cosmic rays is presented in an attempt to establish a relation between these phenomena. A comparison of the nature of the progression of electrotelluric perturbations at two points located in different latitudes following Firor's method of zoning is used in support of this hypothesis. ("The Relation of Variations in the Intensity of Cosmic Radiation with Electrotelluric Perturbations," by A. S. Lashkhi and G. Ye. Gugucava, Institute of Geophysics, Academy of Sciences, Georgian SSR; Tbilisi, Soobshcheniya Akademii Nauk Gruzinskoy SSR, Vol 21, No 4, Oct 58, pp 413-416.)

Lunar Eclipse Seen in USSR

A partial eclipse of the Moon occurred on 24 March which was visible in all parts of the Soviet Union except the most eastern and northeastern parts of the country. The eclipse began at 2215.8 hours Moscow time, reached its maximum phase at 2311.2 hours, and ended at 0006.6 hours. The Earth's shadow covered about 1/4 of the upper part of the Moon. ("Today-Lunar Eclipse"; Moscow, Izvestiya, 24 Mar 59, p 6.)

III. METEOROLOGY

Role of Plain Relief and Coastal Lowlands in Local Weather Formation

The relation of precipitation in regions with certain physical-geographic features to their relief and their remoteness from the sea, and the influence of these same elements of underlying relief on the type of weather are discussed in source.

The studies resulted in the following conclusions.

Discontinuity in the relief of the Russian plainland under consideration encourages the increase in the recurrence of both rainy weather (of mainly frontal origin) and weather with daily convective cloudiness. However, only the contrast in the degree of discontinuity effects the formation of rainy weather, while the formation of weather with cloudiness by day and intensity of precipitations during this weather depends on local differences in discontinuity.

The coastal regions of the lowlands near the Black Sea in the southwestern Ukraine are characterized by a lower recurrence of rainy weather and weather with cloudiness by day than regions remote from the sea because of breeze inversions and the stability of air currents from the sea. However, the intensity of precipitations in cases of rainy weather on the coast appear to be greater than far from the sea.

Despite the increase of precipitations with an increase of distance inland, the recurrence of dry winds and drought weather also increases in this same direction, and this effect is lost since the influence of the nearby sea on the temperature and humidity of the air appears to have a stronger effect on the increase of precipitations. ("Role of Plain Relief and Coastal Lowlands in the Formation of Local Weather," by Ya. I. Fel'dman, Institute of Geography, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geograficheskaya, No 1, Jan-Feb 59, pp 82-85)

Red Snow in Georgia

The Bogdanovskoye region of the Georgian SSR, in the vicinity of the villages of Tambovka and Rodionovka, was the scene of a most unusual snowfall not long ago. A red-colored snow fell throughout the night and by morning had reached a depth of 10 centimeters.

An investigation of the phenomenon is being carried out by the Tbilisi Scientific Research Hydrometeorological Institute, which as yet has made no statement as to its possible origin. ("A Red Snow Fell in Georgia"; Moscow"; Izvestiya, 25 Mar 59, p 6)

IV. SEISMOLOGY

New Volcano on Island of Sakhalin

A Tass dispatch from Yuzhno-Sakhalinsk dated 21 March reports the formation of a new volcano on the Island of Sakhalin. At 1000 hours on 20 March, the inhabitants of a way station on the 23-kilometer Yuzhno-Sakhalinsk--Kholmsk railroad line witnessed this natural phenomenon. In the center of a neighboring valley, the earth suddenly swelled into an enormous dome and to the accompaniment of a series of explosions, an enormous fountain of earth, uprooted trees, and other debris shot 80-100 meters into the air, mingling with a cloud of steam and gas. The eruption of this new volcano continued about an hour but the emission of sulphorous gases can still be seen.

The Yuzhno-Sakhalinsk seismic station registered a weak subterranean shock at the time of the eruption. The Laboratory of Volcanology of the Sakhalin Complex Scientific Research Institute, Siberian Branch, Academy of Sciences USSR, has begun a study of the new volcano. ("New Volcano on Sakhalin"; Moscow, 22 Mar 59, p 6)

New Soviet Seismic Station

A new station for the detection and study of submarine earthquakes was put in operation in Kamchatka. It is the third such station in the Far East. ("From Every Corner of the Country"; Moscow, Pravda, 26 Mar, p 4)

Study on the Effect of Water Saturation on Wave Propagation in Rock

Some results of laboratory studies on the effect of water saturation on the velocity of elastic waves in rock from the Forecarpatian depression are presented. The magnitude and nature of the change in velocities of elastic waves in relation to the water content of the rock are determined. The process of the change in the elastic properties with water saturation is considered by the author to be physicochemical. Depending on the state of the elastic bonds, the velocity of the elastic waves in saturated rock can be more (principally sandstone) or less (clayey rock) than the velocity of elastic waves in a dry sample. The studies confirmed the essential roles of structural pecularities of rock, the type and composition of the bond, and the porosity. The author suggests the use of these relations for interpreting data obtained in well hole shooting. Some lines for further investigations are suggested. ("The Effect of Water Saturation on the Velocity of Elastic Waves in Rocks," by G. I. Petkevich, Institute of the Geology of Mineral Resources; Kiev, Dopovidi Akademii Nauk Ukrains'koi RSR, No 12, 1958, pp 1,324-1,327)

V. OCEANOGRAPHY

Photo of Soviet Deep-Sea TV Camera

A photograph of a new Soviet deep-sea TV camera built by the Institute of Oceanology of the Academy of Sciences USSR appears in the January issue of Znaniye-Sila, a Soviet popular science publication.

The camera is shown in position over the side of a ship before lowering.

The photograph caption reads: Apparatus built by the Institute of Oceanology, Academy of Sciences USSR. Observation of marine animal life and oil prospecting on the sea bottom can be more successfully conducted with the TV camera than by divers. It can also operate at seemingly fantastic depths. But a man can study the underwater world while on a ship, in safe and quiet conditions. ("Television Everywhere"; Moscow, Znaniye-Sila, No 1, Jan 59, p 36)

VI. ARCTIC AND ANTARCTIC

Oceanographic Study of Greenland Sea

An important part of the oceanographic study of the Arctic is the systematic research conducted by Soviet expeditions in the Greenland Sea, which began in 1956. At that time, an oceanographic expedition on the Ob' was working in this area. Later, in the fall and winter of 1957, when the IGY had already begun, this work was continued on the Lena, and in the spring of 1958, by an expedition on the Toros.

Thus, observations in this area are conducted all year. It is possible, therefore, to determine what changes take place from year to year in the ice and water regime of the Greenland Sea.

The water exchange between the Arctic and the Atlantic oceans takes place mainly in the northern part of the Greenland Sea. The current flowing into the Arctic Ocean from the Atlantic brings warm water with it, while the surface current flowing into the Atlantic carries cold water and ice. The quantity of ice in the Arctic seas and, consequently, the navigation conditions depend on the changes in these two currents.

An exploration of the Greenland Sea, as well as of the entire Arctic Basin, is also important for the solution of another interesting problem of oceanography, i.e., the study of the relief of the oceanographic bottom of the Arctic Ocean and of its structure.

Data collected by drift stations on the morphology and geology of the bottom of the Arctic Basin are immediately sent to the Arctic and Antarctic Scientific Research Institute in Leningrad where they are processed and summarized.

These data have made it possible to draw up a new, detailed bathymetric chart of the Arctic Ocean. This chart sums up the results of studies of the bottom relief during the first year of international research.

It turned out that the bottom relief is much more complex and irregular than had been assumed heretofore. There are numerous high mountain ranges, individual mountains, and depressions on the bottom of the ocean which were little known until now. These mountains and depressions are distributed according to a definite pattern, which is also inherent in the above-water mountains surrounding the Arctic Ocean.

Thus, for example, the mountains along the shores of East Greenland, dating back to the Caledonian era, have been known for a long time. Clear indications of a similar relief have been traced to the northeast of Greenland, in the area of the Greenland Sea and the Arctic Basin.

In a similar manner, lines of deep breaks in the earth's crust were discovered at the bottom of the ocean. Two systems of breaks are known in the northeastern part of Greenland, on the Jan Mayen Island in the Greenland Sea, on Spitsbergen, and on Zemlya Frantsa Iosifa; one of the systems extends from northwest to southeast, and the other one is perpendicular to the first.

Two systems of underwater break lines can be traced in the same directions. One of the systems, in the form of frequent parallel curves, extends in a northwesterly direction in the Greenland Sea. The same structural lines are continued in the southeast, in the form of the western continental slope of the Barents Sea, and in the northwest, i. e., in the Arctic Basin, in the form of the continental slope of North Greenland. In this way, it was established that the continental land block of the Russian Platform, with its underwater continuation in the form of the continental shelf on the Barent Sea and the Spitsbergen archipelago in the northwest, is clearly separated from the Canada--Greenland land block.

These discoveries have caused radical changes in the views which prevailed until now regarding the structure of this region. According to previous information on the northern part of the Greenland Sea, it was assumed that a bank existed in the form of underwater isthmus connecting Greenland and Spitsbergen. If this rise, named after Nansen, actually exists, which should be further investigated, it is considerably deeper than had been assumed before. The Nansen Rise is narrower than had been believed and it extends not from west to east, but from north-northwest

to south-southeast, crossing the 79th parallel near the zero meridian. ("IGY in the Arctic--At the Bottom of the Greenland Sea"; Moscow, Nauka i Zhizn', No 1, Jan 59, pp 23-24)

Diving Operations Under Arctic Ice

A group of scientific associates of the Moscow State University and of the Marine Hydrophysics Institute, Academy of Sciences USSR, has returned to Moscow from the drift station Severnyy Polyus-6. During a period of several months the scientists, headed by Prof A. G. Kolesnikov, conducted research on the drift of ice and the temperature exchange in the Central Arctic Basin.

A special set of measuring and registering instruments were prepared for this type of work. The installation of instruments under the ice was carried out by divers using lightweight diving equipment. This was the first time diving operations were performed in the Central Arctic. It should be noted that these were not professional divers but young specialists in geophysics.

Lengthy and detailed preparations preceded this work. Early in 1958, V. I. Kronshtadtskiy-Karev, senior instructor in lightweight diving, was frequently seen at the physics faculty of Moscow State University. This senior specialist in diving operations was training scientific associates, students and laboratory workers for work at the North Pole. The comprehensive training program included a study of the principles of using light-weight diving equipment, the main types of insulating devices operating on oxygen and air, the oxygen pump, and the air compressor; the instructor also supervised underwater operations.

In the fall of 1958, the whole group arrived by plane at Severnyy Polyus-6. They set up their small camp at a distance of about one kilometer from the main camp. The first experimental diving tests were made on New Year's Eve. A ladder was lowered into the test hole used by the hydrologists, which was situated about 150 meters from the divers' camp. The aqualungs, which had been filled in Moscow, were tested. After the physician, V. G. Stranin, had checked the divers, he gave them permission to begin the underwater descent. A powerful underwater lamp illuminated the 3-meter shaft in the ice with a greenish-blue light. The water under the ice was over 4,000 meters deep.

The divers were clothed in warm underwear and a rubber diving suit. The air temperature at this time was minus 40 degrees Centigrade, while the water temperature was minus 1.8 degrees Centigrade. The first man to make the descent was Yuriy Pyrkin. The next one, about an hour later, was V. Savin, chief of the Arctic detachment of Moscow State University.

After the experimental descents proved successful, regular diving operations were begun. To install the instruments, one had to descend 10-15 meters below the ice. All available lighting equipment was used to illuminate the working area. However, several meters below the opening of the shaft it was completly dark and the divers had to grope their way about.

The scientists are convinced that such underwater operations could be performed in any region of the USSR and that they should be used more widely in support of scientific research. ("For the First Time Under the Ice of the North Pole;" Moscow, Sovetskiy Flot, 26 Feb 59)

Activities at Antarctic Stations

The station staff at Vostok, at the south geomagnetic pole, is making preparations for the polar night, which is not far off. The temperature has recently been as low as minus 60 degrees Centigrade. The station has completed the construction of two new, subsnow magnetic pavilions, connected with each other by a 40-meter long passage. The aerologists have put the radio-theodolite in operation. Two new devices for studying the spectra of polar lights are being installed.

After a 17-day traverse over the ice plateau of East Antarctica, the sled-tractor train from Mirnyy arrived at the station Komsomol'skaya. The train consists of three powerful "Khar'kovchanka" caterpillar tractors and six metal sleds loaded with 125 tons of expeditionary freight. The members of this party have penetrated 870 kilometers into the interior of the continent. The first preparatory stage of the forthcoming trans-antarctic expedition has been completed.

This expedition, which is to reach three poles -- south geomagnetic, south geographic, and pole of relative inaccessibility -- will be continued in October 1959. The vehicles were left at the station Komsomol'skaya, and the members of the expedition returned to Mirnyy by plane. In the next few days the station Komsomol'skaya will temporarily discontinue its operation and will renew its activities at the beginning of the next Antarctic spring.

The polar scientists and seamen on the Ob' are working under difficult weather conditions in building the station Lazarev on Queen Maud Land. About 900 tons of various equipment, fuel, and other materials, has been unloaded. The heavy storms, reaching 40-50 meters per second, frequently disrupted the unloading work. The hurricane winds repeatedly broke up the shore ice and forced the expedition members on the Ob' to change their place of anchorage.

While the unloading and construction work was in progress, a group of scientific associates under Prof M. Ravich explored the eastern part of Queen Maud Land. The scientists made a number of geographic discoveries of great interest. In a location with coordinates 72 04 S and 13 37 E, they discovered a number of mountains which were not indicated on the map. In several places, the conical, pyramidal, or jagged mountains, with snow-free slopes, rise 500 to 1,500 meters above the ice sheet, or 3,000 to 4,000 above sea level. Orange-colored lichens were found at an elevation of 2,700 meters. In the crevices of rocks, nesting places of storm petrels were discovered.

The field explorations, which continued for 10 days, were frequently interrupted by a purga, accompanied by winds with a maximum velocity of 40 meters per second.

The Czechoslovak scientist Antonin Mrkos, who spent the 1958 winter at Mirnyy, also took part in the exploration of Queen Maud Land, together with the Soviet polar scientists. ("Today in Antarctica"; Moscow, Vodnyy Transport, 7 Mar 59)

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